Factors Affecting LMS Tool Use in Online Classes

Analysis of Oncourse Data

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My Objectives Today

Introduce

- Introduce you to analytic techniques possible with LMS data
- Discuss my role in a larger study of LMS at IU

Identify

- Identify the factors which contribute to the types of tools enabled in online classes. Our findings suggest:
  - More tools enabled in online classes which are
    - Liberal arts
    - Upper level u/grad
    - Teaching campuses
  - Available LMS tools are more likely to be enabled in online classes at teaching campuses (i.e., the regionals), after controlling for discipline, course level, time trend and class size. (See Table 6.)

Research Design

Study Design

- Non-experimental case study

Unit of Analysis

- Online courses (Oncourse)

Data

- LMS logs of >5K online courses offered over 8 semesters
  - ~225K Oncourse sites
  - ~160K actual course sites
  - ~11K were online courses
    - OI, OA, WW codes
  - ~5K online classes were active, had 10+ students, & had tools enabled
- 5,346 online courses, which enrolled 153,531 students at eight different campuses

Variables

- Classes categorized by
  - *Discipline* – STEM, Professions, Liberal Arts
  - *Course level* – lower u/grad, upper u/grad, graduate
  - *Campus type* – research campus or teaching campus
- Tools enabled in each course
  - Coded by presence or absence (1,0)
  - Index variables to reflect
    - Variety of tools (i.e., the number or frequency)
    - Types of tools (student-content or student-other, see Moore, 1989)
- Covariates
  - Class size
  - Time trend

Table 1.

Disciplines Aligned to Biglan Classification (Top Panel) and Subject Areas (Bottom Panel)

Discipline:	STEM	Liberal Arts	Professions
Biglan:	Hard-Pure-Life	Soft-Pure-Life	Soft-Applied-Life
	Hard-Pure-Non-Life	Soft-Pure-Non-Life	Soft-Applied-Non-Life
	Hard-Applied-Non-Life		
Subjects:	Biological Sciences	Art, Music, Theatre	Business
	Chemistry	Communications	Education
	Computer Science	English	Health Professions
	Earth Science	Humanities	Journalism & Speech
	Engineering	Interdisciplinary Studies	Law & Public
	Environmental Studies	Languages	Administration
	Information Systems	Liberal Arts & Sciences	Library Science
	Mathematics	Philosophy	Parks & Recreation
	Statistics	Social Sciences	Social Service Professions
	Technology (all fields)		

Note: The sample contained no Hard-Applied-Life courses, such medicine or dentistry, which are clinical, non-STEM Professions.

Table 2.

LMS Tools by Enablement and Interaction Type

Default Tools (i.e., Level 0)	**Available Tools** (i.e., Level 1)
Content Tools	*Content Tools*
Syllabus	Calendar
Resources	Modules & Lessons
Library Resources	Podcasts
Interaction Tools	News
Announcements	Web Content
Assignments	eTexts
Gradebook	Publisher DLTs
Messages	Student-Generated Content
	Interaction Tools
	Dropbox
	Tests & Surveys
	Post'em
	Virtual Office
	Email
	Forums
	Chat Room

Table 3.
Summary Statistics of Online Course Sample

	Distribution		Class Size		LN of Class Size	
	Frequency	Percent	Mean	Median	Mean	Median
Total (*N*)	5,346	100.0%	28.7	25	3.22	3.22
Disciplines						
STEM	927	17.3%	29.5	25	3.22	3.22
Liberal Arts	1,570	29.4%	31.7	26	3.32	3.26
Professions	2,849	53.3%	26.8	24	3.16	3.18
Course Level						
UG Lower	2,478	46.4%	31.6	26	3.31	3.26
UG Upper	1,542	28.8%	29.2	25	3.23	3.22
Graduate	1,326	24.8%	22.6	21	3.03	3.04
Campus						
Research	3,194	59.7%	29.5	24	3.22	3.18
Teaching	2,152	40.3%	27.5	25	3.21	3.22

Table 4.
ANCOVAs and Estimated Marginal Means

	Total Tool Variety	Enablement		Tool Type	
		Default	Available	Content	Interaction
Model Test					
Overall $F_{7, 5338}$	39.2***	19.2***	76.2***	25.1***	56.6***
Between-Subjects Tests					
Factors					
Disciplines $F_{2, 5338}$	18.5***	11.5***	9.7***	22.1***	9.9***
Course Level $F_{2, 5338}$	55.0***	19.9***	100.2***	23.9***	140.2***
Campus Type $F_{1, 5338}$	32.4***	24.7***	95.2***	79.9***	1.4
Covariates					
Time Trend $F_{1, 5338}$	0.4	8.7**	1.2	2.1	0.0
Class Size $F_{1, 5338}$	3.7	18.1***	0.2	0.3	6.2*
Grand Mean	**8.76**	**6.35**	**2.41**	**3.32**	**5.44**
Disciplines					
STEM	8.55 $_a$	6.29 $_a$	2.25 $_a$	3.23 $_a$	5.31 $_a$
Liberal Arts	9.01 $_b$	6.46 $_b$	2.55 $_b$	3.47 $_b$	5.54 $_b$
Professions	8.72 $_a$	6.30 $_a$	2.42 $_b$	3.25 $_a$	5.47 $_b$
Course Level					
UG Lower	8.81 $_a$	6.22 $_a$	2.60 $_a$	3.17 $_a$	5.65 $_a$
UG Upper	9.13 $_b$	6.36 $_b$	2.78 $_a$	3.39 $_b$	5.74 $_a$
Graduate	8.33 $_c$	6.47 $_c$	1.85 $_b$	3.39 $_b$	4.94 $_b$
Campus					
Research	8.59 $_a$	6.43 $_a$	2.17 $_a$	3.17 $_a$	5.42 $_a$
Teaching	8.93 $_b$	6.27 $_b$	2.66 $_b$	3.46 $_b$	5.46 $_a$

Note: Model F-value is for a univariate ANCOVA with 3 groups (disciplines, course level, campus type), controlling for the time trend and class size. Pairwise multiple comparisons were computed with a Bonferroni adjustment, and the subscript letter denotes the subset of means within a group that do not differ. Means are estimated at the covariates and may differ from simple means reported elsewhere. (n = 5346)

Table 5.
Course Tool Enablement by Discipline, Course Level, and Campus

		Discipline				Course Level				Campus		
	Total (n=5346)	$\chi^2_{(df=2)}$ †	STEM (n=927)	LibArts (n=1570)	Prof (n=2849)	$\chi^2_{(df=2)}$ †	UG Lower (n=2478)	UG Upper (n=1542)	Grad (n=1326)	$\chi^2_{(df=1)}$ †	Research (n=3194)	Teaching (n=2152)
Default Tools												
Syllabus (c)	96.4%	28.2*	95.7% a	98.5% b	95.4% a	6.7	95.9% d	97.4% d	96.0% d	4.3	96.8% g	95.7% g
Resources (c)	93.5%	8.4	91.5% a	94.4% a	93.7% a	31.7*	91.8% d	93.6% d	96.5% e	10.0*	94.4% g	92.2% h
Library Resources (c)	67.1%	33.5*	59.4% a	66.8% b	69.7% b	97.8*	62.0% d	66.0% e	77.8% f	19.0*	69.4% g	63.7% h
Announcements (o)	95.7%	20.0*	97.2% a	96.9% a	94.6% b	2.6	95.4% d	95.7% d	96.5% d	2.4	95.4% g	96.2% g
Assignments (o)	86.4%	1.4	85.7% a	85.9% a	86.9% a	28.6*	83.7% d	88.2% e	89.3% e	43.8*	89.0% g	82.6% h
Gradebook (o)	97.8%	9.8	97.5% a	96.9% a	98.3% a	14.7*	97.1% d	98.9% e	97.7% d	2.1	98.0% g	97.4% g
Messages (o)	96.3%	13.3*	96.3% a,b	94.8% b	97.0% b	13.8*	95.4% d	96.4% d,e	97.7% e	52.9*	97.8% g	94.0% h
Available Tools												
Calendar (c)	13.4%	86.6*	20.2% a	16.4% b	9.5% c	81.7*	15.8% d	15.7% d	6.0% e	0.0	13.4% g	13.2% g
Modules & Lessons (c)	29.2%	62.9*	21.3% a	35.8% b	28.2% c	41.6*	28.2% d	35.0% e	24.4% f	296.3*	20.4% g	42.2% h
Podcasts (c)	4.4%	1.1	4.9% a	4.5% a	4.1% a	0.8	4.5% d	4.5% d	3.9% d	2.3	4.0% g	4.9% g
News (c)	1.0%	11.2	0.4% a	0.5% a	1.4% a	1.8	0.9% d	1.2% d	0.8% d	1.7	1.1% g	0.7% g
Web Content (c)	2.5%	12.6*	1.8% a	3.6% b	2.0% a	1.6	2.2% d	2.9% d	2.5% d	4.5	2.1% g	3.0% g
eTexts (c)	3.4%	9.6	1.9% a	4.3% a	3.4% a	16.4*	4.1% d	3.8% d	1.7% e	44.2*	2.0% g	5.4% h
Publisher DLTs (c)	2.6%	194.7*	9.3% a	0.8% b	1.5% b	61.1*	4.3% d	2.1% e	0.2% f	113.6*	0.7% g	5.5% h
Student-Generated (c)	12.1%	44.4*	8.5% a	16.6% b	10.9% a	10.6	10.9% d	14.3% d	11.9% d	44.1*	9.7% g	15.8% h
Dropbox (o)	13.1%	36.0*	7.4% a	15.7% b	13.6% b	0.5	13.3% d	13.4% d	12.6% d	7.7	14.2% g	11.6% g
Tests & Surveys (o)	53.9%	28.0*	55.2% a	58.9% a	50.7% b	598.4*	61.6% d	66.3% e	25.0% f	59.3*	49.6% g	60.3% h
Post'em (o)	0.9%	7.1	1.4% a	1.2% a	0.6% a	18.7*	1.5% d	0.2% e	0.7% d,e	0.1	0.9% g	1.0% g
Virtual Office (o)	1.1%	63.1*	3.5% a	1.3% b	0.3% c	36.1*	2.1% d	0.6% e	0.1% e	48.2*	0.3% g	2.4% h
Email (o)	2.7%	4.2	3.3% a	3.0% a	2.3% a	1.3	2.9% d	2.3% d	2.7% d	10.7*	2.1% g	3.5% h
Forums (o)	65.8%	60.3*	59.3% a	73.2% b	63.8% a	188.5*	70.4% d	71.7% d	50.3% e	154.2*	59.2% g	75.6% h
Chat Room (o)	37.9%	88.5*	40.8% a	46.3% b	32.3% c	161.2*	43.1% d	42.2% d	23.2% e	54.9*	33.8% g	43.9% h

† A Bonferroni adjustment was made for the chi-squared proportion difference tests for each categorical variable. This lowered the p-value of the individual chi-squared tests from 0.05 to 0.0023 (i.e., 0.05⁄22), with significance represented by an asterisk (*), such that a chi-squared value (df = 2) $\leq$ 12.21 is ns and a chi-squared value (df = 1) $\leq$ 9.35 is ns.

Table 6.
Logistic Regressions Predicting Enablement of Four Available LMS Tools

	Modules & Lessons		Tests & Surveys		Chat Rooms		Forums	
	B	*OR*	*B*	*OR*	*B*	*OR*	*B*	*OR*
Discipline								
STEM	−0.335	0.715***	−0.130	0.878**	−0.012	0.988	−0.364	0.695***
Liberal Arts	+0.227	1.254***	−0.129	0.879**	+0.155	1.167***	+0.176	1.193***
Professions	+0.109	1.115*	+0.259	1.296***	−0.143	0.867***	+0.187	1.206***
Course Level								
UG Lower	−0.311	0.733***	+0.495	1.640***	+0.205	1.228***	+0.263	1.301***
UG Upper	+0.188	1.207***	+0.661	1.937***	+0.271	1.311***	+0.326	1.386***
Graduate	+0.123	1.131*	−1.156	0.315***	−0.476	0.621***	−0.590	0.555***
Campus Type								
Research	−0.585	0.557***	−0.026	0.975	−0.089	0.914**	−0.251	0.778***
Teaching	+0.585	1.795***	+0.026	1.026	+0.089	1.094**	+0.251	1.286***
Covariates								
Time Trend	+0.040	1.041**	+0.043	1.044***	−0.098	0.907***	+0.030	1.031*
Class Size (ln) ‡	+0.283	1.328***	+0.558	1.747***	+0.032	1.033***	−0.336	0.715***
Constant	−1.052	0.349***	−0.266	0.767***	−0.056	0.946	+0.439	1.550***
Nagelkerke R^2	0.106		0.175		0.063		0.083	

Each tool has sample size, n = 5346 ‡ The natural log of class size is mean-centered for interpretability.
Note: *Deviation (effect) coding used (Menard, 2009). OR is the Odds Ratio, which is Exp (B).*
$^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$